REMARKS

In response to the final Official Action of April 7, 2006, claims 1, 2, 9, 11-16, 21, 22 and 24-27 have been amended to delete the recitation of the phrase "step of" and to remove the phrase "characterized in that." This amendment of the claims does not raise any new issues.

Mobile station claims 25-27 have been amended to remove means plus function language and to substitute structural elements. These structural elements are supported by the originally filed application, including Figure 12 and the accompanying description at page 20, line 10 through page 21, line 11. No new issues are raised by this amendment of the mobile station claims.

The final Official Action rejects claims 1, 2, 5, 6, 8-13, 24, 25 and 27 under 35 U.S.C. §102(b) as anticipated in view of WO 01/31958, Hämäläinen. Specifically, with regard to claim 1, reference is made by the Office to page 7, line 12 through page 8, line 12, as well as page 10, line 26 through page 11, line 8. In both of these passages of Hämäläinen, there is described an arrangement for performing a transition for inter-frequency handover. More particularly, the recited passage at page 7, line 12 through page 8, line 12 describes a situation where due to high interference, a mobile or base station is using its maximum power allocated for that particular user and more power is requested through the closed loop power control. The need for inter-frequency handover is then observed as power levels are not changed despite higher power requested.

At the passage recited at page 10, line 26 through page 11, line 8, there is described another way to notice when inter-frequency handover needs to be performed. Here, non-orthogonal narrowband interference after de-spreading is measured (as a relative measure against the current narrowband actual signal power) and if its level exceeds a threshold, interfrequency handover is made.

In both of the recited situations in Hämäläinen, there is nothing stated or suggested about an outer-loop power control or two thresholds which are key features of the present invention. Specifically, in claim 1, it is recited that there is changing the operation of the mobile station into the combined slotted communication mode and measurement mode for preparing an interfrequency handover, if at least a criterion specifying that a quality of a downlink signal relating to a channel on which communication takes place between the mobile station and a mobile communication system in the continuous communication mode is worse than a quality represented by a first target value. With respect to the first target value, it is specified that this value depends on a second target value and that the second target value is related to an outer loop power control of a transmission power of the downlink signal.

It should be pointed out that the term "outer loop power control" has a well-established meaning in the relevant art. For example, the book Introduction to WCDMA for UMTS Radio Access for Third Generation Mobile Communications, revised and updated edition Spring 2001, edited by Harri Holma and Antti Toskala, John Wiley and Sons, Ltd., specifically points out at pages 34-36 (copy enclosed as Attachment A) what the term "outer loop power control" means and, in particular, how it compares and contrasts with "closed-loop power control."

In Hämäläinen there is no disclosure or teaching with regard to the use of outer loop power control. Furthermore, as mentioned above, Hämäläinen is totally silent about the use of two thresholds for purposes of controlling interfrequency handover of a mobile station. Thus, in summary, Hämäläinen discloses a closed-loop power control. As mentioned above, this term has a well-established meaning in the art as shown in the above-mentioned publication at page 34. Such a closed-loop power control is not the same as the outer loop power control specifically pointed out and claimed in the present invention.

Applicant further reiterates the arguments which it presented in its previous amendment mailed on December 29, 2005 and, in particular, the arguments presented at page 8, line 11 through page 10, line 24 with respect to claim 1 and the arguments presented at page 10, line 25 through page 12, line 12 with regard to the remaining claims.

Furthermore, in rebuttal to the "Response to Arguments" portion of the final Official Action at page 16 thereof, it is noted that the Office states that Hämäläinen discloses "...interference is related to an outer loop power control of a transmission power of the down link signal and the target values reflect the fact that it is higher than normal." Applicant, as stated above, has shown that Hämäläinen does not disclose or suggest the observation of interference related to an outer loop power control of a transmission power of the downlink signal. Therefore, it is respectfully submitted that applicant's arguments filed on January 3, 2006 (the Official Action mailed on December 29, 2005) should be considered persuasive for the reasons set forth therein, as well as for the reasons presented herewith.

In short, it is respectfully submitted that there is a crucial difference in the well-established meaning of the terms "outer loop power control" and "closed-loop power control" and that Hämäläinen's failure to disclose or suggest a method employing outer loop power control in the manner as disclosed and claimed in the present application prevents the claims from the present application from being anticipated or suggested by Hämäläinen.

Since claim 1 is believed to be not anticipated by Hämäläinen, it is respectfully submitted that claims 2-23, all of which ultimately depend from claim 1, are further distinguished over Hämäläinen either taken alone or in combination with the additional art cited; namely, US patent application publication 2002/0126739, Tiedmann, Jr. et al, US patent application publication 006081714, Wakizaka, or US patent application publication 006807429, Subrahamanya.

With respect to independent method claim 24, this method recites a method for controlling an interfrequency handover of a mobile station in which a determined quality factor value is compared to a first target value for performing a blind interfrequency handover and comparing the determined quality factor value to a second target value and that the second target value is arranged to relate to an outer loop power control of a transmission power of the downlink signal. For similar reasons as those presented above with respect to claim 1, method claim 24 is also believed to be not anticipated by Hämäläinen and therefore is believed to be allowable.

Similarly, independent mobile station claim 25 and independent mobile station claim 27 recite elements which have the same effective limitations as those recited above with regard to method claim 1 and, for similar reasons, are believed to be distinguished over Hämäläinen. Since claim 25 is believed to be distinguished over Hämäläinen, it is respectfully submitted that claim 26, which depends from claim 25, is further distinguished over Hämäläinen in combination with Wakizaka.

In view of the foregoing, it is respectfully submitted that the present application as amended is in condition for allowance and such action is earnestly solicited.

Respectfully submitted,

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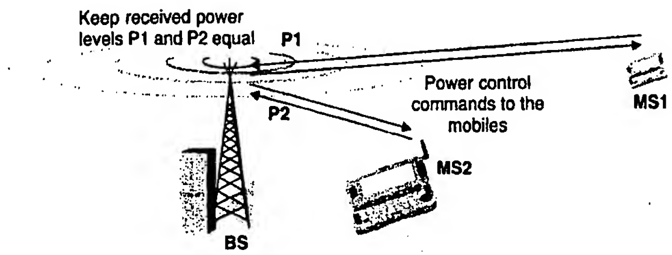

Figure 3.8. Closed-loop power control in CDMA

Figure 3.8 depicts the problem and the solution in the form of closed-loop transmission power control.

Mobile stations MS1 and MS2 operate within the same frequency, separable at the base station only by their respective spreading codes. It may happen that MS1 at the cell edge suffers a path loss, say 70 dB above that of MS2 which is near the base station BS. If there were no mechanism for MS1 and MS2 to be power-controlled to the same level at the base station, MS2 could easily overshout MS1 and thus block a large part of the cell, giving rise to the so-called near–far problem of CDMA. The optimum strategy in the sense of maximising capacity is to equalise the received power per bit of all mobile stations at all times.

While one can conceive open-loop power control mechanisms that attempt to make a rough estimate of path loss by means of a downlink beacon signal, such a method would be far too inaccurate. The prime reason for this is that the fast fading is essentially uncorrelated between uplink and downlink, due to the large frequency separation of uplink and downlink band of the WCDMA FDD mode. Open-loop power control is, however, used in WCDMA, but only to provide a coarse initial power setting of the mobile station at the beginning of a connection.

The solution to power control in WCDMA is fast closed-loop power control, also shown in Figure 3.8. In closed-loop power control in the uplink, the base station performs frequent estimates of the received Signal-to-Interference Ratio (SIR) and compares it to a target SIR. If the measured SIR is higher than the target SIR, the base station will command the mobile station to lower the power; if it is too low it will command the mobile station to increase its power. This measure–command–react cycle is executed at a rate of 1500 times per second (1.5 kHz) for each mobile station and thus operates faster than any significant change of path loss could possibly happen and, indeed, even faster than the speed of fast Rayleigh fading for low to moderate mobile speeds. Thus closed-loop power control will prevent any power imbalance among all the uplink signals received at the base station.

The same closed-loop power control technique is also used on downlink, though here the motivation is different: on the downlink there is no near–far problem due to the one-to-many scenario. All the signals within one cell originate from the one base station to all mobiles. It is, however, desirable to provide a marginal amount of additional power to mobile stations at the cell edge, as they suffer from increased other-cell interference. Also on the downlink a method of enhancing weak signals caused by Rayleigh fading with additional power is needed at low speeds when other error-correcting methods based on interleaving and error correcting codes do not yet work effectively.

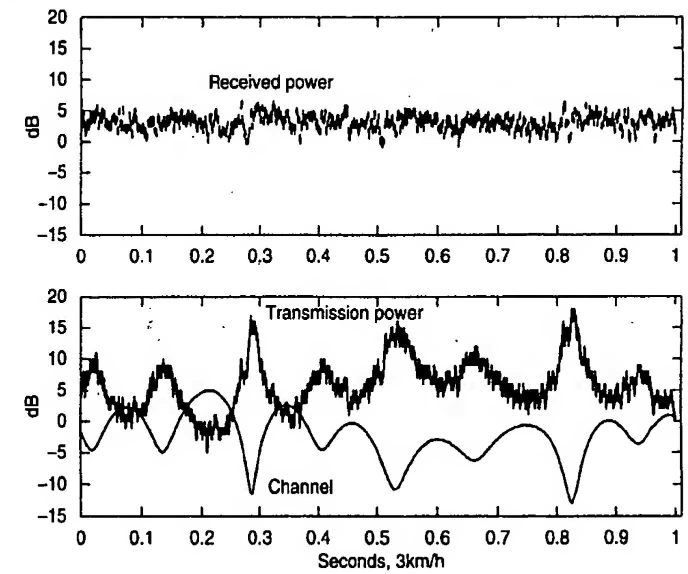

Figure 3.9. Closed-loop power control compensates a fading channel

Figure 3.9 shows how uplink closed-loop power control works on a fading channel at low speed. Closed-loop power control commands the mobile station to use a transmit power proportional to the inverse of the received power (or SIR). Provided the mobile station has enough headroom to ramp the power up, only very little residual fading is left and the channel becomes an essentially non-fading channel as seen from the base station receiver.

While this fading removal is highly desirable from the receiver point of view, it comes at the expense of increased average transmit power at the transmitting end. This means that a mobile station in a deep fade, i.e. using a large transmission power, will cause increased interference to other cells. Figure 3.9 illustrates this point. The gain from the fast power control is discussed in more detail in Section 9.2.1.1.

Before leaving the area of closed-loop power control, we mention one more related control loop connected with it: outer loop power control. Outer loop power control adjusts the target SIR setpoint in the base station according to the needs of the individual radio link and aims at a constant quality, usually defined as a certain target bit error rate (BER) or block error rate (BLER). Why should there be a need for changing the target SIR setpoint? The required SIR (there exists a proportional E_b/N_0 requirement) for, say, BLER = 1% depends on the mobile speed and the multipath profile. Now, if one were to set the target SIR setpoint for the worst case, i.e. high mobile speeds, one would waste much capacity for those connections at low speeds. Thus, the best strategy is to let the target SIR setpoint float around the minimum value that just fulfils the required target quality. The target SIR setpoint will change over time, as shown in the graph in Figure 3.10, as the speed and propagation environment changes. The gain of outer loop power control is discussed in detail in Section 9.2.2.1.

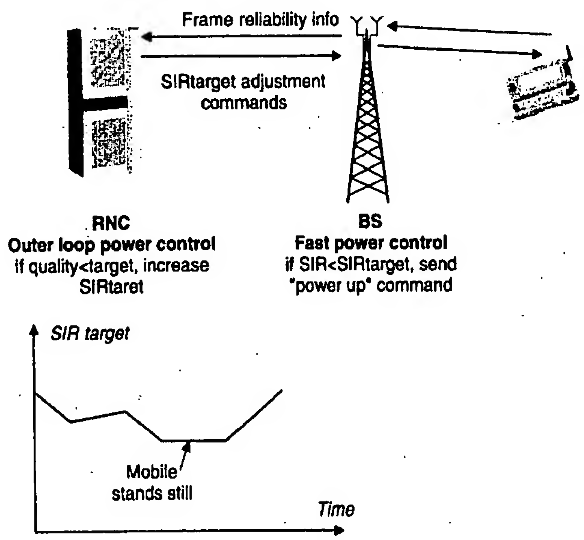

Figure 3.10. Outer loop power control

Outer loop control is typically implemented by having the base station tag each uplink user data frame with a frame reliability indicator, such as a CRC check result obtained during decoding of that particular user data frame. Should the frame quality indicator indicate to the Radio Network Controller (RNC) that the transmission quality is decreasing, the RNC in turn will command the base station to increase the target SIR setpoint by a certain amount. The reason for having outer loop control reside in the RNC is that this function should be performed after a possible soft handover combining. Soft handover will be presented in the next section.

3.6 Softer and Soft Handovers

During softer handover, a mobile station is in the overlapping cell coverage area of two adjacent sectors of a base station. The communications between mobile station and base station take place concurrently via *two* air interface channels, one for each sector separately. This requires the use of two separate codes in the downlink direction, so that the mobile station can distinguish the signals. The two signals are received in the mobile station by means of Rake processing, very similar to multipath reception, except that the fingers need to generate the respective code for each sector for the appropriate despreading operation. Figure 3.11 shows the softer handover scenario.

In the uplink direction a similar process takes place at the base station: the code channel of the mobile station is received in each sector, then routed to the same baseband Rake receiver and the maximal ratio combined there in the usual way. During softer handover only one power control loop per connection is active. Softer handover typically occurs in about 5–15% of connections.

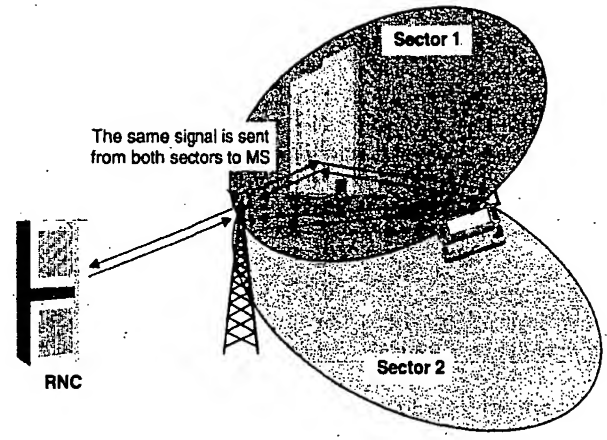

Figure 3.11. Softer handover

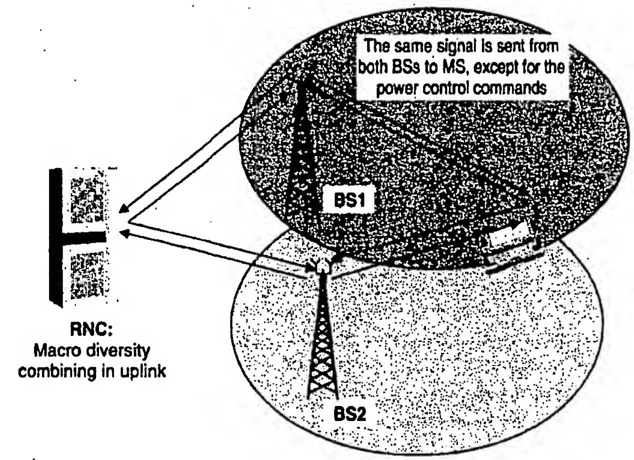

Figure 3.12. Soft handover

Figure 3.12 shows soft handover. During soft handover, a mobile station is in the overlapping cell coverage area of two sectors belonging to different base stations. As in softer handover, the communications between mobile station and base station take place concurrently via two air interface channels from each base station separately. As in softer handover, both channels (signals) are received at the mobile station by maximal ratio combining Rake processing. Seen from the mobile station, there are very few differences between softer and soft handover.

However, in the uplink direction soft handover differs significantly from softer handover: the code channel of the mobile station is received from both base stations, but the received